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Presidential Address.

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Ladies and Gentlemen—

On my retirement from the position of President of the Society, I wish to state how highly I have appreciated the honour which you conferred on me, and I take this opportunity of thanking the members of Council, officers and members, for their kindness and consideration in helping me to carry on the work of the Society. We are greatly indebted to those members who have presented papers during the season. The papers have been of not only great interest but of wider range than heretofore, and I feel sure it is a step in the right direction. I cannot but think that all matters affecting the general welfare and betterment of the conditions of life come within the scope and functions of our Society equally with matters of scientific interest, whether they be subjects of historic interest to guide us, research work of the present, or problems of the future, to consider. The field of the Society is wide, and extending with the progress of science and knowledge.

The papers presented to the Society this year have been of a varied character. The first this session was by Professor Woolnough on the "Physiographic Elements of the Swan Coastal

Plain," a paper throwing light on the geological history of this portion of the State.

Mr. J. S. Battye's paper on "Causes which led to the Colonisation of Western Australia" was a valuable contribution to the history of our State, and brought before us the need of some organisation to save from oblivion many of the interesting documents, sketches, photographs and data concerning the early settlement of the Colony. As the number of the early settlers is rapidly decreasing, efforts should be made to collect and sort out historic data before it is too late.

Mr. W. Kingsmill brought before the Society the subject of "Acclimatisation" and the very interesting work which has been carried out under his directions. This work is not only of great interest but is also of economic value to the State, and it is to be regretted that it is so little known or appreciated by the public.

"Some aspects of Town Planning" was the subject of a paper by Mr. W. A. Saw, a subject which is slowly but surely being realised as an important factor in our lives. The improvement in environment must increase the health and happiness of the community, and minimise the production of the criminal element. In the building up of our towns and cities we all realise the necessity to prevent the growth of slum conditions.

Professor Dakin's paper on his investigations into a serious form of sheep disease dealt with a subject of considerable importance and economic value to the State.

A paper by Mr. A. R. L. Wright on "Houses in Western Australia" dealt with a subject which is of general interest. The climate and other conditions naturally must affect the design and arrangements of our homes.

One of the most interesting papers read during the session was presented by Mr. D. A. Herbert on the "*Nuytsia floribunda*, its structure and its parasitism," in which he pointed out its parasitical functions, and at last cleared up the mystery which has surrounded this well known tree for so many years.

The last paper of the session was read by Professor Ross on "Light and the Ether" in which he explained the interesting theory recently advanced which threw doubt on the usually accepted theory that a ray of light travels through the ether of space in a straight line, and the especial interest in this year's Solar Eclipse, in the attempt of astronomers to answer this question.

I think the Society may be congratulated on this list of papers, and I trust that in the future we may have many papers of a similar nature affecting this land of ours, which is rich in rare and interesting subjects. No time should be lost in collecting data, as much of the fauna and flora is rapidly disappearing before what we are pleased to call civilisation.

The natural history of Australia stands out unique from other parts of the world. The evolution which has produced so many changes in other lands appears in this Island Continent to have almost stood still or moved but slowly. This may be due to its separation from Asia before the Carnivora appeared there. Indeed, the extraordinarily slow development in Australia points to what an immensely important factor Carnivora must have been in the great struggle for existence and survival of the fittest in the great process of evolution.

While the mammals of other lands are absent in Australia, the earliest forms of vertebrate mammals in the fossil beds of Europe are represented by the marsupial Kangaroo of to-day. Many of the Birds, Fishes, and Crustacea of Australia living at the present time have long ceased to exist in other parts of the world. In the Vegetable Kingdom, also, plants of the long past Carboniferous age are still represented in living form in Australia, whilst our aboriginal men do not appear to have evolved very far from their Stone-age ancestors. I have alluded to these conditions so as to indicate how wide and unique is our field of natural history, to raise our interest and enthusiasm, to advocate study and record, for it is one of the functions of our Society to stimulate and assist research in this wonderland of nature.

SCIENCE AND CIVILISATION.

I feel that at the termination of the Great War it will be opportune to bring before you, for your consideration, a few points in connection with science and its relation to progress and civilisation.

In referring to the events of last year it is impossible to think of any work or progress which has not been connected with or affected by the Great War. Each of my predecessors took for his Presidential address some of the educational or industrial problems which could be expected to arise after such a struggle, and now that the war is practically over, the problems of Peace are found to be more serious and more complex than those of the War.

The termination of the War has come perhaps more completely and more suddenly than was anticipated. It could hardly have been expected that the German Navy would surrender without a fight, and be interned in a British harbour, and that the Allies would so soon be in occupation of the cities of the Rhine.

As the War involved a greater number and variety of nations than any previous war, so the problems of Peace must affect every country of the world, for the spread of international commerce, with the rapid means of communication by railway, steamer, post and telegraphs, make any treaty or agreement between nations a matter of world-wide consequence.

We have to go back to the Wars of Napoleon to witness the breaking up of Empires and the creation of new States on anything like the scale of last year. The Prussian victory over the French in 1870-1 consummated the federation of the separate German States into one German Empire, and the defeat of the Germans last year broke up that Empire into separate States again. I think there is little doubt that the separate German States, possessing common interests, language and ideals, will coalesce, probably with the addition of Austria, into a United States of Germany, and if this is the right view it should make us all the more careful to look at our own position, to see that we do not lag behind in the march of Progress in Peace and War.

We cannot build any hope that the War of 1914 will alter human ideas or change mankind, nor that the late war will be the last one; we can only hope to postpone such a calamity as long as possible.

The change of the various types of Government in Europe into more Democratic and Socialistic forms, whether they prove permanent or not, must have an influence on our own National organisation and that of our allies. The War has shown many weak spots in our social organisation, and every citizen who has the welfare of his country at heart should study the matter so as to ascertain the causes and remedies and assist in carrying out urgently necessary reforms for the advancement, welfare, and happiness of the people.

Democracy is the equality of the educated and uneducated, and the good and bad alike, and as all modern systems of government must ultimately come to the collective vote of the individual, Right, Justice, and Freedom will depend on the intelligence and judgment of the individual and everything that can elevate the mind and body will advance the State to these ideals, and the only means to attain these ends is a sound education not of the few but of the many, for by knowledge the Nation gains power while the uneducated is a danger to himself and a menace to the community.

Europe will always be the dominating factor in Peace and War, and it is to Europe we must look for the settlement of problems between the Nations. Europe is by far the most complex of all the great divisions of the Earth, with about fifteen different languages, innumerable and increasing types and forms of religion, without any prospect of assimilation or agreement, and systems of government and politics still more numerous and unstable. Surely we see in these more than enough elements for misunderstanding and trouble, but when we go outside Europe we are faced with further problems in the various forms of language, religion, and politics. With all these perplexing differences we naturally look for some factor common to all nations, by which a structure of Justice and Freedom can be built up, and of all the factors in human affairs Science is the only one which is universal and common to them all; it cannot be altered by language, religion, or politics, although it has often been crippled by each.

As to Australia, her isolated position from all other continents resulted in a unique and slower course of evolution in her flora and fauna, and politically she also differs from other continents in having practically one race of people, one language, and the oceans as her frontiers: she can thus develop her destiny untrammelled by the many complex problems and close competition of other nations separated, as in Europe, by a five-wire fence, a river, or a narrow strip of neutral ground.

Many bold and just experiments in social and industrial organisations have originated in Australia, but the question whether the absence of the stimulus of close contact with the ideas and progress of other countries will be an advantage or otherwise time alone will answer.

In the Great War, science has been used to the utmost extent by all the participants, and now with the prospect of Peace, surely science will be called upon to assist more than it has ever been before, in the work of reconstruction of national life and industry. We cannot go backward, nor can many of the unhappy and unjust conditions of living be allowed to continue. If the conditions of human affairs be made better as the result of the War, the sacrifices involved will not have been in vain.

I refer to science in its widest sense, as the correlation of knowledge, for to know a truth in relation to another truth is to know it scientifically.

It would be impossible in a short address to do more than take a hurried glance at the history of scientific thought which has attracted mankind from the earliest ages, and realise how it has been encouraged and suppressed at various periods of history.

Of all the sciences, astronomy has always appealed to mankind and has been studied from the earliest times. From time immemorial the recurring alternation of day and night and the seasons have appealed to men's thoughts, and attempts have been made to understand and explain these workings of nature. Phenomena of non-recurring or isolated events, such as thunderstorms or earthquakes, have generally in the past, and I fear sometimes in the present day, been attributed to what is called the supernatural, which I presume meant that there was no explanation available. The motions of the Heavenly bodies were observed and studied in ancient times by the Chaldeans, Chinese, Arabs, Egyptians, and Greeks, and it is from the Chaldeans and Arabs that many of the names used in astronomy are derived, but it is to the Greeks that great advances in astronomy and other sciences are due, and if the Greek astronomers had possessed the telescope and the pendulum, they would probably have brought this science to a point not actually reached till the time of Sir Isaac Newton.

When we think of the theories and attempts to explain natural occurrences without the instruments of precision or the vast accumulation of scientific data which we now possess, we can only express admiration for thoughts and theories of ancient inquirers. I might allude to the very interesting and ingenious explanation made by the ancient Egyptians of the alternation of day and night. It was assumed that the earth, presumably flat, was covered by a great dome or arch, and day was caused by the sun travelling along the inner side of the dome from sunrise to sunset; while from sunset to sunrise the sun on its return journey crossed the outside of the dome, where it was hidden from the earth, and the stars were but holes in the dome through which the sunlight could be seen. This primary idea was not accepted by the Greek astronomers, as the theory of Hipparchus and Ptolemy (about 160 B.C.) assumed that the sun and other bodies revolved round the earth as a centre. This explanation gave way to the theory propounded by Copernicus about 1500 A.D., which is the theory now accepted by science.

So with other sciences the great doctrine of the conservation of energy and matter has become one of the basic principles of physics and chemistry, and the latter science has made extraordinary advances during the last few decades, and was one of the most important factors in the War, and made use of by both sides. The newer science of biology is scarcely less important, and has revealed some of the most beautiful operations in nature. For instance, for long it was thought that trees and plants derived the material for their structure from the soil on which they grew, until the biologist showed that about 95 per cent. of the tree is derived, not from the soil but from the air and water, through the agency of sunlight acting on that wonderful material chlorophyll, the green substance of the leaves separating the carbon from the carbonic acid gas in the air and the hydrogen from the water, and these two elements combining to form the wood structure and returning the oxygen to the air, a process which is reversed when we burn up the timber. The sister science of bacteriology has shown how great is the part played by bacteria both for good and evil from a human point of view.

The ruins of the great empires of Babylonia and Assyria testify to the ability of the engineers and builders. Also Persia, India, China, and Egypt can show that works of great magnitude were achieved which would even in modern times be considered formidable, with all our appliances and resources. Indeed, these ruins show the careful thought and accurate scientific knowledge that were brought to bear on these ancient works.

It is curious to note that most of the mighty nations of antiquity began and flourished in more or less rainless regions, and thus made the study of hydraulics a necessity, and engineering science was directed to water conservation and irrigation, and the remains of these works show what a high degree of efficiency had been attained.

In the ancient world, science reached her greatest height when Greece was at the zenith of her renown; and her temples, monuments and works stand out for all time as a tribute to her greatness in science and art, and to her philosophy and freedom of thought.

Rome never rose to the same high position in science and philosophy as her elder rival, Athens. Indeed, Rome was, perhaps, more utilitarian; the great works of the Roman engineers and architects stand to-day, monuments to their ability and skill. Of this classic period I might mention a few of the great thinkers and workers in science such as Euclid, Hipparchus, Ptolemy, Archimedes, Hero, and Democritus, names which prove that the prosperity and renown of any nation are intimately associated with scientific knowledge and its application.

With the rise of Christianity and the descent of the Northern Barbarians upon Rome and Greece, civilisation and science suffered an eclipse—and over Europe spread a dense pall of scientific ignorance during the dark ages from the 4th century, when Hypatia, a celebrated woman philosopher and mathematician, was murdered by a fanatic mob at Alexandria—to the time of Galileo in the 17th century. But even in the darkest hour science never lacked its devotees, and the sacred torch of science was kept alight by the great Califs of Bagdad and other cities of Arabia, who encouraged science and especially astronomy. The old Greek works were translated into Arabic, and the Arabian astronomers carried on the work and made many advances during the centuries of intellectual darkness in Europe.

Galileo is famous not only for being one of the earliest to use the telescope, and for his experiments in dynamics, but also because his teaching of the doctrine of Copernicus that the earth revolved round the sun brought him under the ban of the Inquisition, which forced him, in 1633, to abjure the Copernican theory, and thus brought about the first clear-cut conflict between science and the powers of the dark ages.

When we look back at the dark ages, that long period of 1,400 years when scientific thought and experiments were banned as impious and evil, we must realise that but for this period of stagnation and oppression science and civilisation would have advanced vastly beyond the position we occupy to-day. With the progress of scientific knowledge and thought up to the first few centuries Anno Domini, many of the great inventions of modern times might well have been made a thousand years ago. The ancient world, especially Greece, was close on the threshold of great discoveries.

The steam engine, which is, I think, the most important invention in the history of mankind and one of the greatest factors in civilisation, was created and operated by Hero, a Greek engineer of Alexandria as far back as 150 B.C.

This engine, called by Hero the "Aeolipile" was of a primitive rotary type, in which the pressure of steam was maintained in the boiler, and the steam. escaping under pressure from jets, caused the engine to rotate.

Hero also described his air and water pumps with cylinders and pistons, and it was not until the lapse of eighteen centuries that the steam engine with cylinders and pistons was designed by Papin and others, and steadily developed into the steam engine of to-day.

The name Electricity is derived from "Elektron," the Greek name for Amber—a material which, when rubbed, attracts small particles of straw, paper, etc.

Thales of Militus, 600 B.C., is credited with having pointed out this property of Amber, but there does not appear to be any record of further knowledge on the subject until the 16th century, when Gilbert published a work on Magnetism and Electricity.

The printing press was known to the Chinese many centuries ago, but not until the 16th century was it re-invented in Europe.

I think we may fairly assume that but for the dark ages railways, steamers, electric machinery and appliances might have been invented a thousand years instead of about one hundred years ago.

It is hard to realise what our present conditions would be if the sciences of astronomy, chemistry, engineering and biology and political economy and social conditions had ten centuries of knowledge and experience behind them. Indeed we have lost a thousand years of progress.

When we look back on the ruins and wrecks of the civilisations of Babylonia, Egypt, Greece, and Rome, we may well ask "Is our own civilisation and science secure from similar annihilation?"

During the last hundred years the teaching of science has advanced perhaps more than in any other period of history and it has become world-wide. The same laws and facts are taught in the class rooms and laboratories in every University throughout Europe, Asia, Africa, America, and Australia. The starry heavens, the seas and mountains, the trees and flowers—sublime works of nature—are common to all mankind, and the study of these forms the language and thoughts of science.

There are two main factors which science teaches: one, that we must always be prepared to review our theories and doctrines in the light of new discoveries and new data, for there is no finality to scientific knowledge. The scientific beliefs of one generation have frequently been abandoned by succeeding generations, because their observation and data have been based on the apparent and from insufficient knowledge has failed to point the real factors. Lack of observation instruments prevented early investigators from analysing and proving their theories, and even in the present day doubt has been thrown on the existing assumption that light travels through space in a straight line uneffected by gravitation as of the sun, and it is expected that the solar eclipse of last month will decide this question.

We are liable to come to wrong conclusions if we only observe an occurrence from one point of view. How often do we notice when travelling fast in a railway carriage that the sparks from the engine appear to rush past; in a nearly horizontal streak it is hard to realise that the appearance of the fiery track is due entirely to our rushing past the slowly falling sparks, whereas a person watching the passing train would notice that the sparks are slowly falling vertically to the ground. This simple illustration should teach us to consider both sides of the story before we come to a conclusion.

Science teaches us that the more we know the more there is to learn, and every new discovery opens a field for further investigation. If I may be permitted to use a simile, take two circles, one small and the other large, and take the area of each circle to represent the extent of knowledge in each case and let the circumference be called the horizon of ignorance, and you will see that as the area of knowledge increases so does the horizon of ignorance increase.

Adam Gowan White, says of knowledge: "Truth is nothing more than the essence of organised knowledge." This expression grows and alters as knowledge grows and alters; it is dynamic, not static.

I have rapidly and in a very fragmentary manner referred to some of the phases in the history of science and its influence on civilisation, but with such a vast subject it is impossible to deal with it adequately in one evening.

There are one or two modern phases, however, to which I would like to allude. For some years before the War, Germany was recognised as one of the foremost, if not the foremost, nation in the encouragement of science and in the employment of scientific works in her industries.

Her scientific workers had gained for her practically a world-wide monopoly, especially in aniline dyes and also in many other chemical industries, and this was largely due to their research

—thorough and systematic research. I think the War has made it clear to us that any manufacturer who does not utilise a highly qualified scientific staff has no chance against the manufacturer who does.

We have frequently heard the statement that science made Germany brutal. With this I do not agree. It might be true to say that Germany made science brutal, or rather that she used science in a brutal manner; but war in itself is brutal.

The difference between British and German science is that Germany has built successfully by systematically collecting and co-ordinating the scientific data and investigation of her own and other countries. Information of inventions and industries is more easily obtained from German publications than elsewhere. But British scientists have always led the way in scientific philosophy and great inventions. British science is built more on initiation, whereas German science is more encyclopædic.

No country can compare with Great Britain in the record of famous men of science, and there is no branch of science wherein British scientists do not hold a first place. In support I may remind you of a few names such as Bacon, Newton, Gilbert, Napier, Dalton, Harvey, Watt, Davey, Faraday, Joule, Young, Stevenson, Brunel, Tyndal, Maxwell, Huxley, Darwin, Lister, Herschell, Crooks and Kelvin.

Coming to Australia, the value of scientific training is slowly but surely being recognised as a necessary factor in our national life if we are to hold our place in the world. The Federal Government has realised the importance of this matter by establishing an advisory council of science and industry, and I hope the Government support will be continued.

Our Education Department has also realised the economic value of scientific teaching and has introduced the system into many of the State schools, and the Department is to be congratulated on its work. Science, however, requires a sound general education as a basis, and I feel sure the time has arrived when the maximum compulsory age of school attendance should be raised from 14 to 16 years. A girl or boy is ill equipped to start life at the immature age of 14; indeed, under modern conditions, and when we realise the great increase of general knowledge during the last 50 years that the standard of education has automatically and irresistibly advanced, it will be admitted that such a child is distinctly handicapped in starting life compared with those who have been able to continue their education to a later age.

The educational value of the teaching of science in the schools was recognised some years ago in Great Britain, the three main subjects being physics, chemistry, and biology.

Physics is always an attractive subject to a boy. It explains natural phenomena and machines in which a boy is interested and with which he is familiar, especially as there are so many experiments in physics which are simple and convincing and which can be performed by a boy in his spare time. As a certain amount of mathematics is required in physics, such experiments offer a practical confirmation of many mathematical problems, which is also an advantage to the student.

Chemistry has suffered more in the past than any other branch of science. In elementary teaching its educational possibilities have been greatly underrated. Elementary chemistry demonstrates to the boy as he proceeds from a simple example, revealing the nature of the chemical changes, and proving step by step in the process, so that the student gains a sound idea of a logical and ordered argument. Chemistry demonstrates this factor better perhaps than any other science.

Biology also possesses a high educational value, as it trains the power of observation. Although many of the processes are complex and difficult to follow in the early stages, their study is calculated to make a boy take a greater interest in life.

Surely the teaching, at the impressionable school age, of the truths and logical conclusions of science must be for good and must be beneficial to the youth, for a sound training and judgment are two essentials in whatever path of life he follows.

The modern schools and continuation classes which are designed to encourage education beyond the statutory age are a great advance. Great Britain during the War raised the age of compulsory attendance at schools under certain conditions from 14 to 16, so that Western Australia has a lead to follow.

The Public Service is sadly behind in these matters. Under the Public Service regulations the age of 14 is accepted, in that a boy of this age can apply for entry to the Service, and if he passes the qualifying examination (G) at this age he can be appointed temporarily as a messenger. When he attains the age of 16 he is appointed as a junior officer, and before 18 years he has to pass a second examination, known as the "F" examination, which is more or less a test of his official attainments. His way is then clear without further educational tests to the highest appointment in the Service. As there are always many applicants from 14 to 16 years of age and as priority counts, students of the University or secondary schools are practically barred from entering the Public Service. This system is a contrast with that of the Professional division, where high educational and technical experience are necessary qualifications. No doubt with the advent of the University and secondary schools the regulations will be modified in due course, and the sooner the better so as to meet new conditions.

Any discussion in connection with education would be incomplete without a reference to our University, which was founded by Act of Parliament in 1911, and the first lectures began on 31st March, 1913.

Before considering our own University it might be interesting to go back to the 12th century and notice the difference in the origin and development of the medieval Italian and French Universities. The early Italian Universities started as a guild of students desirous of increasing their own knowledge, who combined and contributed to the salary of the lecturers, and also provided suitable accommodation. On the other hand the French Universities, such as that of Paris, originated from a Society of Masters: men well versed in Arts and Literature, who combined to give a course of instruction, and provided the necessary accommodation and charged fees to those students attending the classes. All the older European Universities followed one or other of these systems, and as the Universities grew in power and influence they were frequently the subject of great pressure from the Government and from the Ecclesiastical bodies, and in some instances Universities were started in opposition.

Both these systems have undergone modifications from time to time. All the older English and Scottish Universities show distinct traces of their original prototype. Oxford and Cambridge belong to the French or "Master" University type, while the Scottish Universities clearly show their Italian or "Student" University origin.

Many Universities have been founded by private individuals but in almost every instance tuition fees are charged by the University, irrespective of its origin.

The University of Western Australia differs, in that it was founded and is financed by the State, and no tuition fees are charged. Although fees are charged at other Universities it does not follow that the student himself has to bear the cost. There are numerous instances of public-spirited persons who have provided the money for the payment of University fees. The Carnegie trust is a notable instance where the fees of a large number of students who attend the Scottish Universities are paid. When the student has completed his course and has started his subsequent career, he is expected to repay to the Trust the amount of the fees paid for his tuition.

The whole tendency of the present day is to remove every obstacle from the path of the student seeking knowledge at the centre of learning.

The preamble of the University of Western Australia Act states:—

> And whereas it is desirable that provision should be made for further instruction in those practical arts and liberal studies which are needed to advance the prosperity and welfare of the people:
>
> And whereas it is desirable that special encouragement and assistance should be afforded those who may be hindered in the acquisition of sound knowledge and useful learning by lack of opportunity or means:
>
> And whereas for these purposes it is expedient to incorporate and endow a University within the State of Western Australia.

Provision is made by the Act for payment of £13,500 per annum.

The enrolments for the first year (1913) numbered 184, and since then the number of students has more than doubled. The number of students is as follows:—

Year.	Number of Students enrolled.
1913	184
1914	182
1915	214
1916	214
1917	236
1918	270
1919	400

This involves an increase in the accommodation and in the Teaching Staff, so that an increase in the annual grant is urgently required. It is a matter of disappointment that, with the exception of Sir Winthrop Hackett, nothing in the way of an endowment has been made to the University. No doubt when the real value of the institution is better understood and appreciated the University will have many more friends and supporters.

There are many persons who do not approve of a free University, and it is said that students do not appreciate learning if it is free. I do not agree with this view. I cannot believe that students do not appreciate the teaching and personal care given by the Teaching Staff, nor that graduates think less of their degrees because the State provided the facilities for obtaining them. No doubt there are students who join without any intention of continuing and who will drop out during the terms, and such students hinder others of more serious intent. To charge fees to all students simply in order to offer some obstacle to those who have no intention of studying would be hardly just to genuine students.

This State is trying the new experiment of a free University, which is a great step forward in education, but with only six years of existence, four and a half of which were under more or less war conditions, I feel that the time is too short to say that the experiment has proved a failure. I am sure it would be a retrograde step to return to the old system of charging fees for tuition.

One of the difficulties of any change or improvement in an educational system is the long time which must elapse before the real effects of a change can be understood or realised. Certainly it cannot be less than 20 years; not until the students of to-day have become factors in the life and development of the State, will the real value of University training be appreciated.

The whole question of Education is undergoing a change, but it must of necessity be slow. A sound education for all is undoubtedly the best investment of the State. The question is not, "Can we afford free education," but "Can we afford to do without it?"